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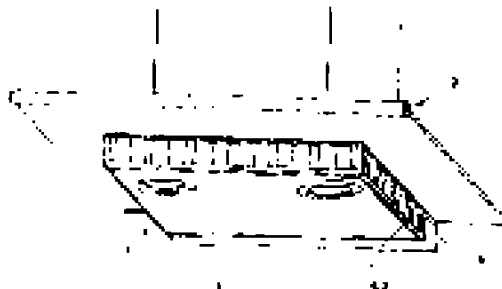
(56) Published prior art taken into consideration  
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DE 41 31 988 C2  
DE 27 20 201 C2  
DE 197 53 687 A1  
DE 41 38 846 A1  
DE 298 11 000 U1  
AT 3 60 206 B  
US 3,910,782

The following information has been obtained from the documents submitted by the applicant

(54) Filter Arrangement for an Extractor Hood

(57) The invention relates to a filter arrangement for the separation of particles and/or drops of liquid from air flowing through the filter system. The filter arrangement comprises a filter system disposed in a plane and a vortex separation that is disposed in the boundary region of the filter system. The vortex separation is provided with a devices, which, compared with the filter system, create a higher flow speed and stronger turbulence of the circulating air. The vortex separator can be made of X-cyclone elements, curved or horizontal elements or from expanded metal.



[0001] The invention relates to a filter arrangement for extractor hoods for the separation of particles and/or liquid droplets, which are used particularly in kitchens above a stove or the like.

[0002] Filter arrangements of this type are known. DE 27 20 201 C2 and US-PS 3,910,782 disclose filters, which comprise a first row of profiles disposed mutually spaced from one another and open in the direction of the gas flow and a second row of profiles disposed mutually spaced from one another and open opposite to the direction of the gas flow, the mutually adjacent longitudinal edges of two adjoining profiles of one row disposed next to each other projecting into the inner space of an opposite profile of the other row.

[0003] In these separation grids, the distance between the two profile rows is dimensioned such that the air flowing through experiences a multiple reversal of direction. The free passage cross-section amounts to 30% of the total grid area, depending on the separation grid - type 10. An increase in the air velocity of 3-10 times occurs as a result of the reduction in cross-section inside the separation grid. The separating action of the grid is based on this velocity increase, as a result of which the liquid droplets and solid particles contained in the air are of course also accelerated, as well as on the multiple reversal of direction of the circulating air. The accelerated liquid droplets and solid particles cannot follow the directional change and impinge upon the inner surfaces of the profiles of the second row. On the surface of these, the liquid droplets form a liquid film that gradually runs off downward and passes through special orifices in the frame of the separation grid into a collecting rail disposed beneath the separation grid.

[0004] DE 298 11 000 U1 proposes a grease trap filter, which uses two or more layers of a grid, which comprises slotted bridges produced on both sides of a metal sheet by means of a stamping operation, the grids being disposed within the filter such that the slotted bridges extend vertically or obliquely downward and the grids are held together by a common frame. A further grid, the slotted bridges of which are disposed horizontally, may be located between two grids, respectively, having slotted bridges extending vertically or obliquely downward.

[0005] Furthermore, grease filters formed of multi-layer expanded metal are known. For example, DE 197 53 687 A1 discloses a multi-layer conically configured expanded metal filter, which comprises on the outside an integrally formed planar circular disk ring for good contact against the filter frame.

[0006] A significant disadvantage of these plate-shaped or conically configured grease filters, in which the air generally taken in by a blower flows through the plate plane, is the reduced edge extraction.

[0007] In order to eliminate this disadvantage, it has already been proposed in DE 41 38 846 A1 to divide the filter surface into partial sections through which air flows and which inhibit the flow in the case of a filter cartridge, via the filter surface of which the air to be filtered is suctioned in. In the interest of improved boundary extraction, partial sections are provided, which inhibit the flow and increase toward the center of the filter surface. This is associated with the disadvantage, of course, that the overall filter surface is restricted in favor of flow optimization.

[0008] Furthermore, plate-shaped separators with transverse flow for separating liquids from a gas stream, in particular an oil mist, are known from the industrial sector, in which separators

vortex elements, known as X-shaped vortex elements, are used, which effect a deflection of the gas stream and consequently liquid separation (DE 41 31 988 C2). Plate-shaped separators with transverse flow of this type are not suited for use in commercial kitchens or in domestic extractor hoods.

[0009] It is the object of the invention to create a filter arrangement, in which air flows through a filter plane and which has improved boundary extraction.

[0010] This object is achieved with the characteristics of claim 1, advantageous embodiments are the objects of the dependent claims. A preferred application is defined in claim 48.

[0011] According to the invention, the filter arrangement, provided for the separation of particles and/or liquid droplets from the air flowing through the filter arrangement, comprises at least one filter layer disposed in one plane and a boundary filter, which is disposed in the boundary region of the filter layer. The boundary filter is preferably provided with devices, which - in comparison with the filter layer - effect increased flow velocity and more pronounced turbulence.

[0012] As is known from the prior art, the filter layer 3 may be formed of one or more layers of an expanded metal and/or a non-woven material and/or paper, the boundary filter being constructed as a turbulence filter, as a baffle filter and/or as an expanded-metal, non-woven or paper filter.

[0013] Through this arrangement of a vortex separator, through which the flow passes transversely, clearly improved boundary extraction can be achieved. It is advantageous if the flow resistance of the boundary filter is lower than the flow resistance of the filter layer, since fumes in the boundary region of the filter arrangement are prevented from leaving the boundary region. Moreover, the higher flow velocities resulting from the lower flow resistance intensifies the turbulence. As a result, the particles or liquid droplets are separated more efficiently in the boundary filter, particularly when the boundary filter is configured as a vortex filter or as a baffle filter.

[0014] The boundary filter, which is configured as a vortex separator, comprises at least one, preferably two rows of devices, disposed successively one behind the other, for the formation of turbulence in the air flowing through the vortex separator. Since, for example, an extractor hood has a peripheral edge, it is advantageous if the entire edge also receives peripheral boundary extraction in order to prevent fumes from leaving the suction region of the extractor hood. It is therefore advantageous if boundary filters are disposed peripherally in the boundary region of the filter layer.

[0015] Furthermore, one embodiment of the invention provides that the boundary filter be disposed on the boundary region, preferably perpendicularly to the plane of the filter layer, such that liquid droplets separated in the boundary filter flow into the boundary region of the filter layer and are absorbed there.

[0016] If the filter layer comprising one or more layers of expanded metal and/or non-woven material and/or paper is bordered by a U-shaped frame, a further advantageous embodiment of the invention provides that the upper frame leg be extended in its dimension in order to receive the boundary filter. In order to be able to redirect the liquid droplets separated in the boundary filter here too, in a

preferred version the frame comprises orifices in the region of the boundary filter disposed thereon

[0017] An boundary filter that has proven useful in practice is a vortex separator comprising a row of X-shaped vortex elements, preferably two rows of X-shaped vortex elements disposed one behind the other. In the case of two rows of X-shaped vortex elements disposed one behind the other, their curved legs engage each other while maintaining an air gap. When the flow passes transversely through the X-shaped vortex elements disposed this way, turbulence forms so that the particles and/or liquid droplets contained in the air are thrown against the walls of the legs and are separated.

[0018] In another advantageous embodiment, it is provided that the filter layer together with the boundary filter or the filter layer together with the vortex separator and the frame form a cartridge filter.

[0019] The filter arrangement as such and, in particular in the configuration as a cartridge, is preferably used in the extraction orifice of an extractor hood or chimney, which has an air conveying device for the extraction of air via the extraction orifice. Furthermore, the cartridge may be disposed exchangeably and is therefore additionally service-friendly.

[0020] Moreover, the filter arrangement offers the possibility of arranging a screen on the boundary filter, which screen extends radially outward beyond the edge of the filter arrangement, in order to guide fumes and vapors toward the filter arrangement, in particular toward the boundary filter.

[0021] In another embodiment of the vortex separator configured as an boundary filter, horizontal curved elements are used, the elements being placed at the edge of the filter arrangement such that the inflowing air first impinges upon a shape that is advantageous for the flow. During the further course of the air through the vortex separator, it is deflected at least by another curved element.

[0022] In a first embodiment of the curved element, it has a C-shaped configuration. The convex "back" of the C-shape is associated with the filter edge. Free legs of another C-shaped curved element engage in the concave "orifice" of the C-shape. As a result, a sharp deflection of the air stream takes place, precipitating grease or water droplets on the surface of the vortex separator.

[0023] Further embodiments of the curved element are V-, S-, drop- or dumbbell-shaped. Within the scope of the description of the figures, this will be addressed in more detail. According to the invention, the vortex separator may also be formed of a combination of at least two different shapes.

[0024] When a plurality of curved elements has to be mounted, it is disadvantageous if these elements have to be mounted individually. It is therefore advantageous if the curved elements are disposed on a common base plate. This base plate may be located both above and beneath the curved elements. It is advantageous, however, if the base plate is disposed beneath because residue of the grease or water condensate running off the curved elements end up on the base plate, which is then supplied in one piece with the curved elements to a cleaning process, for example in a dishwasher.

[0025] It is also advantageous if the base plate extends along the edge of the filter layer. With this arrangement, the condensate and grease separated by the boundary filter can run off via the base plate and be absorbed or bound by the filter layer. It is advantageous if the base plate is inclined toward

the filter layer. If the base plate is not inclined, the condensate does not necessarily run off the edge of the filter arrangement because the air stream constantly suctions it toward the center of the filter.

[0026] The curved elements are not only limited on one side by the base plate, but instead they are associated with a further plate on the other side. These two plates together form a duct. It is advantageous if, when viewed in the flow direction, the two plates form a widening gap, because then these plates form a nozzle. This nozzle shape intensifies the condensation of grease and water.

[0027] It is advantageous if the vortex separator, together with the curved elements, is produced by means of injection molding. This requires little cost for mass production despite the complex design of the vortex separator. Production from plastic is particularly cost-effective. However, a vortex separator produced from light metal by means of injection molding is also suitable for mass production. Moreover, it is more resistant to cleaning that, where applicable, may be aggressive, than a vortex separator made from plastic. Aluminum has proved particularly useful as a material for the production of a vortex separator from light metal.

[0028] If an boundary filter is disposed at least on one longitudinal side of a filter layer, the boundary filter may also at the same time replace this part of the filter layer frame. This saves the material for this frame part at the same time.

[0029] In another embodiment of the vortex separator, it is part of an extractor hood. Due to this structural proximity to the extractor hood, a multitude of functions can be designed more conveniently. This will be addressed in more detail below in the continuation of the description.

[0030] As already stated above, the boundary filter, preferably configured as a vortex separator, is located in the boundary region of the filter arrangement. As also already mentioned, it is important that precisely the boundary region of a filter arrangement is subjected to excellent suction, so that migrating vapor fumes cannot leave its effective range. It is therefore advantageous if the boundary filter comprises a downwardly directed inflow orifice.

[0031] A boundary filter, which when exposed faces the vapor fumes, may possibly impede handling during cooking. It is therefore advantageous if the boundary filter has a fold-out configuration so that it is extended only as required. It is also advantageous if the boundary filter is configured such that it can be connected and disconnected, because, if fumes occur only slightly, suction through the middle filter layer may be sufficient. As a result, energy costs can be saved. This ability to connect and disconnect it may be carried out manually in a simple way. It is also possible, however, that it is implemented automatically. The automatic system required for this purpose is controlled by a sensor, which may be configured as a pressure sensor.

[0032] Since the boundary filter may become severely polluted, it is advantageous if it easy to disassembly. This may take place, for example, by means of a simple plug or snap-fit connection.

[0033] In addition to the embodiments of the vortex separator configured as a boundary filter, an X-shaped vortex element or horizontal curved elements, according to the invention also a boundary filter formed of expanded metal is a possible option. Expanded metal is known in many different embodiments - also from the field of kitchen filters.

However, to ensure that a vortex separator made of expanded metal fulfills the condition of low flow resistance for the boundary region of the filter layer, the expanded metal must be configured to be considerably more air-permeable here than a filter layer. What is important in this embodiment is that the condensate is able to pass from the expanded metal toward the filter layer. For this reason, in a vortex separator made of expanded metal, the surface of the expanded metal is inclined toward the filter layer.

[0034] In an embodiment of the invention, the expanded metal of the boundary filter and the expanded metal of the filter layer are produced in one piece. In order to ensure the air permeability of the boundary filter, the expanded metal in the region of the boundary filter is formed, where applicable, of only a single layer of expanded metal.

[0035] The expanded metal for the boundary filter, however, may also be a separate component. This has the advantage that the boundary filter is a less bulky component and is therefore easier to handle during cleaning.

[0036] Although with a boundary filter made of expanded metal no notable shapes – as for example with the curved elements – are required, it is nevertheless advantageous if the boundary filter is surrounded by a component produced by means of injection molding. This advantage becomes apparent when, for example, the elongated "housing" of a boundary filter is produced from an extruded material, the cross-section of the material thus being constant over its entire length. If, for example, a local material variation is required – viewed across the length of the material – it is not possible to accomplish with an extruded material. However, for example, a bore or a nozzle bead can be implemented by means of injection molding.

[0037] Extruded profiles that border a boundary filter in the longitudinal direction can be held in their desired position in a simple way by means of caps attached on the end faces. For this purpose, the caps comprise corresponding recesses on the side facing the extruded profiles.

[0039] Occasionally it is possible that the boundary filter preferably produced from expanded metal loses condensate drops before they have reached the filter layer. In this case it is advantageous if the inflow orifice for the fumes is provided with an inner edge – on the bottom of the boundary extraction. As a result, the drops cannot flow back through the inflow orifice. This rim additionally offers the advantage that the inflow orifice becomes a nozzle that favors the condensation of the fumes.

[0039] The effect of more intensive boundary extraction may also be reinforced by arranging at least two filter layers next to one another, each with at least one boundary extraction device. This results in alternating fields of strong and of moderated suction.

[0040] In regions where a high amount of fumes is produced – for example in large kitchens or in the case of otherwise intensive kitchen use – it may be advantageous if a collection channel is provided in the extractor hood due to increased condensate formation. The collected condensate can then either evaporate again in the case of a lower occurrence of condensate or be discharged by an emptying system.

[0041] The filter arrangement according to the invention will be explained in more detail with reference to the drawings, wherein:

[0042] Fig. 1 is a filter arrangement configured as a cartridge filter;

[0043] Fig. 2 is an arrangement of a boundary filter in the form of a vortex separator;

[0044] Fig. 3 is a frame with a filter layer and vortex separators;

[0045] Figs. 4a-4e show various basic shapes of the vortex separator in the form of curved elements;

[0046] Fig. 5 is an extractor hood with a removed vortex separator with C-shaped elements;

[0047] Fig. 6 is a sectional view of a vortex separator with C-shaped elements;

[0048] Fig. 7 is a partial cross-sectional view through a boundary filter with an air feed device;

[0049] Fig. 8 is a cartridge filter with a vortex separator with C-shaped elements;

[0050] Fig. 9 is a cross-section of Fig. 8;

[0051] Fig. 10 is a cross-sectional view through a boundary filter made of an expanded metal;

[0052] Fig. 11 is a cartridge filter with a boundary filter housing with an extruded profile;

[0053] Fig. 12 is a cross-sectional view of Fig. 11 (mounted state);

[0054] Fig. 13 is an extractor hood with several filter arrangements disposed next to one another.

[0055] Fig. 1 shows a filter arrangement 1 for separating particles and/or liquid droplets from the air flowing through the filter arrangement 1, comprising at least one filter layer 3 disposed in one plane and a boundary filter, which is configured as a vortex separator 6 and which is disposed peripherally in a boundary region 4 of the filter layer 3. The filter arrangement 1 is configured here as a cartridge filter. The filter layer 3 is bordered by a U-shaped frame 5, on which the vortex separator 6 is disposed. The filter arrangement 1 is located beneath an extractor hood 2.

[0056] The filter arrangement 1 is configured such that the flow resistance of the vortex separator 6 configured as a boundary filter is lower than the flow resistance of the filter layer 3, thus achieving good boundary extraction.

[0057] This is additionally supported by a screen disposed on the vortex separator 6, which screen extends radially outward beyond the edge of the filter arrangement 1 and guides fumes and vapors toward the filter arrangement 1, in particular toward the vortex separator 6.

[0058] Fig. 2 shows that the vortex separator 6 is formed of two rows of X-shaped vortex elements 7, 8 which are disposed one behind the other, the inner legs 7.1, 8.1 of the two rows of X-shaped vortex elements 7, 8 mutually engaging each other while maintaining an air gap, so that the suctioned air passes transversely through the X-shaped vortex elements. As a result, turbulence is formed so that the particles and/or liquid droplets contained in the air are thrown against a wall of the legs 7.1, 8.1 and are consequently separated.

[0059] The rows of X-shaped vortex elements 7, 8 forming the vortex separator 6 are disposed on the boundary region 4 and perpendicularly to the plane of the filter layer 3 such that separated liquid droplets flow into the boundary region 4 of the filter layer 3 and can be absorbed there.

[0060] In the version illustrated in Fig. 2, the filter layer is bordered by a U-shaped frame 5. The X-shaped vortex elements 7 are disposed in such a way that their outer legs are flush with the front edge of the frame. However, condensate may also be precipitated on the outer surfaces of the X-shaped vortex elements 7 that point toward the edge of the filter arrangement 1. So that the condensate does not drip off the edge of the frame 5, it is advantageous if the frame 5 comprises run-off elements that transfer the condensate to the filter layer.

[0061] If the X-shaped vortex elements 7, 8 were merely placed on the filter layer 3 without fixing them, they could slide out of place and the gap between their legs 7.1 and 8.1 would have an undefined geometry. It is therefore advantageous that the frame 5 is adjacent to the X-shaped vortex elements 7, 8 and therefore offers the possibility of connecting the X-shaped vortex elements 7, 8 to the frame 5. This is advantageously achieved by means of fastening.

[0062] Fig. 3 illustrates a portion of the U-shaped frame 5 with a lower frame leg 11 and an upper frame leg 10, the upper frame leg 10 have an elongated design, in order to receive the X-shaped vortex elements 7, 8. If no frame 5 is provided, then with sufficient stability of the filter layer 3 the X-shaped vortex elements 7, 8 may be screwed directly to the filter layer 3.

[0063] It is furthermore shown that the frame 5, in the region of the X-shaped vortex elements 7, 8 disposed on it, comprises orifices 9 for discharging the liquid running off from the X-shaped vortex elements 7, 8.

[0064] The proposed filter arrangement 1 is suited particularly for the separation of grease and grease droplets or of water and water droplets from the air flowing through the filter arrangement 1, however is not restricted to these.

[0065] Figs. 4a to 4e show various shapes of "horizontal curved" elements 12 in a top view. These elements embody an important component in a form of construction of the vortex separator 6 functioning as a boundary filter. When suctioned air 13 enters an extractor hood 2 in the boundary region 4, it impinges upon the outwardly directed streamlined shape (rounded or pointy) of the elements. The flow resistance is therefore low, and the extraction of the fumes is impaired only insignificantly. During the further course of the air, it impinges upon at least one further element 12. Due to the wound path between the elements 12, a sharp deflection of the partial air streams occurs. At the walls of the elements, grease or water droplets contained in the air stream are thrown against the wall of the elements 12 and thereby deposited. The illustrated elements of Figs. 4a to 4e share the common fact that always two identically shaped elements 12 (although partly with opposite orientation) interact for air deflection and separation. This does not necessarily have to be the case, however these element shapes selected by way of example have such a shape that they form narrow and sharply deflecting ducts with each other.

[0066] The elements of Fig. 4a may be referred to as C-shaped or also U-shaped. V-shaped elements 12 can be seen in Fig. 4B. In the embodiment of Fig. 4c, they are S-shaped or wave-shaped elements 12. The elements 12 of Fig. 4D (drop shape) and 4e (dumbbell shape) represent voluminous elements. For material savings reasons, however, these elements may also be configured to be hollow on the inside. There is no risk of the deposition of condensate in these cavities if the cavities are closed with a covering plate - which then at the same time serves an air guide element.

[0067] Fig. 5 shows an extractor hood 2 with a vortex separator 6 removed from the front side - the filter layer, which is not illustrated - and configured as a boundary filter. The vortex separator 6 comprises two rows of C-shaped elements 12. In the front row, the "C" elements are disposed with their "backs" facing outward. The "C-elements" of the inner row engage with their legs in the concave region of the "C-elements" of the front row.

[0068] Fig. 6 shows in detail the vortex separator 6, which serves as the boundary filter and which is equipped with the C-shaped elements 12. The suctioned in air passes from below via an inflow orifice 16 into a collecting duct 17. Here, the air flow is then divided into individual partial streams, which then flow through between the C-shaped elements 12, in order to be combined again thereafter into one air stream. The C-shaped elements 12 are disposed on a base plate 14. The base plate 14 and the C-shaped elements 12 form a unit that has been produced by means of injection molding. In the installed state, the vortex separator 6 is covered on its top.

[0069] The boundary filter 6 may have a fold-out design. It can thus be unfolded as needed, and, in the unused state does not impair the appearance of the device.

[0070] The boundary filter may be provided with a closing device, which is not shown. The boundary extraction or the boundary filter 6 can be connected as required. This results in two operating states, on one hand extraction only via the filter layer 3 and on the other hand extraction via the filter layer 3 and the boundary filter 6. The connection and disconnection of the boundary filter may be carried out by hand actuation or manually and/or automatically or and/by motor, preferably via a flap, which is not shown, or a slide (not shown) which may be disposed upstream or downstream of the boundary filter.

[0071] Automatic connection and disconnection of the boundary filter 6 may be controlled by a sensor system, preferably as a function of the air quantity to be purified.

[0072] The ability to connect and disconnect the boundary filter 6 may take place automatically, preferably in that a spring -pre-stressed flap (not shown) is provided, which opens and closes automatically as a function of the pressure difference between the outside of the filter arrangement (upstream) and the vacuum side of the filter arrangement (downstream), preferably as a function of the selected blower stage. A flap of this type may also be designated as a dynamic pressure flap.

[0073] Additionally, Fig. 7 shows a cross-section through a vortex separator 6 serving as a boundary filter and comprising curved elements 12. The suctioned air 13 travels via the inflow orifice 16 into the collecting duct 17, where due to the large radius of curvature it is deflected carefully in the direction of the center of the extractor hood. It flows through the curved elements 12, condensate 19 being separated. The elements 12 have not been shown in sectional views here in the drawing. Due to the inclined base plate 14, the condensate runs onto the surface of the filter layer 3, where it is collected and/or bound. This illustration clearly shows that the base plate 14, together with a plate disposed above it of the extractor hood body, forms a widening nozzle. The vortex separator 6 is held on the extractor hood housing by a snap-fit element 18 (fastening device). When this snap-fit element 18 is released, in this embodiment the vortex separator 6 can be removed together with the filter layer - which is configured here as a cartridge.

[0074] Fig. 8 shows, in the disassembled state, a filter layer 3 that is configured as a filter cartridge. The vortex separator 6 is disposed at the front edge. Above the vortex separator 6 a counter-piece is disposed, which is tensioned together with

the vortex separator 6 and as a result is fixed to a front part of the frame 5 of the filter cartridge. A recessed grip 20 has been designed to be included in the rear region of the filter cartridge so that it does not impair the air flow and consequently the filter process.

[0075] Fig. 9 is very similar to Fig. 7, with the exception that in Fig. 9 the filter layer 3 is configured as a cartridge filter. The frame 5 of the filter cartridge and the vortex separator 6 are tensioned with each another. The vortex separator 6, on its right outside, comprises a snap-fit element 18, which allows it to be latched to the housing, which is not shown of the extractor hood 2.

[0076] Figs. 10 to 13 explain another design solution for a boundary filter 6. This is a boundary filter 6 comprising at least one expanded-metal layer.

[0077] A filter layer 3 with a regular number of layers can be seen on the left in Fig. 10 illustrated in a cross-sectional view. These layers may be various expanded-metal layers, but also be combinations with paper and/or non-woven layers. As the hatched area indicates, the filter layer 3 also extends into the region of the boundary filter 6. Here, however, the number of layers of the boundary filter 6 has been reduced over the filter layer 3, and the active layer here is made of expanded metal. This reduction in the number of layers is necessary in order to keep the flow resistance in the region of the boundary filter 6 low. On the other hand, however, the design engineer also has to make sure that there is a sufficient number of expanded-metal bars so that grease and/or water droplets are sufficiently deflected and can be precipitated on the obstacle, which an expanded-metal bar constitutes. Due to adhesion, the condensate initially adheres to the expanded metal in the region of the boundary filter 6. Due to the illustrated incline of the expanded metal, however, the condensate 19 gradually migrates toward the filter layer 3. The condensate is then absorbed and/or bound here.

[0078] The boundary filter 6 is disposed in a housing 21. This housing 21 is illustrated as one part and as a plastic injection molded part in Fig. 10. In the left region, the housing 21 comprises a fork-shaped clamp, by which the boundary filter 6 made of expanded metal is fastened to the filter layer 3. In the right region, the boundary filter 6 comprises a snap-fit element 18, which is attached to a U-shaped elastic part. The lower region of the boundary filter 6 is particularly important. A round inflow orifice 16 can be seen here. Further inflow orifices 16 are located behind and in front of the sectional plane. The inflow orifice 16, however, may also be configured as a slot extending across the entire boundary side. To ensure that the inflow orifice 16 has low flow resistance, it is rounded in the suction region. However, the inflow orifice 16 also extends into the space beneath the expanded metal. This space is also referred to as the collecting space 22. This collecting space 22 has the advantage that condensate possibly dripping off the expanded metal cannot run off downward via the inflow orifice 16. This would negatively affect hygiene conditions in the cooking area. If condensate collects in the collecting space 22, this condensate can be evaporated again and carried away when the extractor hood is operating, provided that the occurrence of condensate is relatively low. Should condensate then still be present here, this device can be emptied during the removal of the vortex separator 6 - for example for cleaning purposes.

[0079] In Figs. 11 and 12, the boundary filter 6 is received by two extruded longitudinal parts. An upper part 23, a lower part 24 and two caps 25 form a housing for the boundary filter 6, which,

as shown in Fig. 10, is configured as an elongated thin-layered expanded-metal filter of the filter layer 3. A perspective exploded view is illustrated in Fig. 11. In the assembled state, the boundary filter 6 is held, for example, on the frame 5 of a cartridge filter, even without further fasteners. To ensure that the caps 25 can be plugged on the end faces of the parts 23 and 24, corresponding slots must be provided on the sides of the caps 25 facing the parts 23 and 24.

[0080] With sufficiently narrow dimensioning of the slots, good clamping forces can be achieved, as a result of which the boundary filter 6 then has high mechanical stability.

[0081] An assembled boundary filter 6 can be seen in a cross-sectional view in Fig. 12. The upper part 23, the lower part 24 and the expanded metal of the boundary filter 6 substantially form the boundary filter 6 configured as an expanded-metal filter. One cap 25 is disposed behind the sectional plane here. The parts 23 and 24 clamp the filter layer 3 in place and thus fix the boundary filter 6 to the filter layer 3. The inflow orifice 16 is formed by the joining of the lower ends of the parts 23 and 24. Since the parts 23 and 24 are extruded components, the inflow orifice 16 is slot-shaped here. However, the upwardly extended, lower edges of the parts 23 and 24 not only create a nozzle 15 - as already shown in Fig. 10 - but also two collecting spaces 22 for condensate that may be dripping off.

[0082] The lower part 24 is illustrated as being inclined outward. As a result, fumes accumulating beneath the filter layer 3 of the extractor hood 2 are prevented from leaving the extraction region thereof. It is also advantageous that the inflow orifice 16 faces this accumulation region.

[0083] An extractor hood 2 with three truncated pyramid-shaped filter elements disposed next to each other are illustrated in Fig. 13. Each of these filter elements is provided with a filter layer 3 and boundary extraction. This boundary extraction is located at least in one section of the lateral, slanted regions of the truncated pyramid. At least one layer of expanded metal is disposed behind the inflow orifices 16 and thus forms the boundary filter 6. The expanded metal of the boundary extraction preferably has a lower flow resistance than the expanded metal of the central filter layer 3. Due to the boundary extraction implemented here, in conjunction with the configuration of being disposed next to one another, advantageous large-area suction occurs even in the middle region of an extractor hood. In the case of an extractor hood with a large extraction area - as illustrated in Fig. 13 - increased condensate formation takes place. It may therefore be advantageous if an additional collection channel for the condensate is present in the illustrated extractor hood design. Due to the filter arrangement being configured in a truncated pyramid form, a large filter area is made provided.

#### Patent Claims

1. A filter arrangement (1) for an extractor hood for separating particles and/or liquid droplets from air flowing through the filter arrangement (1), comprising at least one filter layer (3) disposed in one plane and a boundary filter disposed (6) in at least one boundary region of the filter layer (3), **characterized in that** the boundary filter configured as a vortex separator.
2. A filter arrangement (1) for an extractor hood for separating particles and/or liquid droplets from air

flowing through the filter arrangement (1), comprising at least one filter layer (3) disposed in one plane and a boundary filter disposed (6) in at least one boundary region of the filter layer (3), characterized in that the boundary filter (6) has lower flow resistance than the filter layer (3).

3. A filter arrangement according to claim 1 or 2, characterized in that the boundary filter (6) is preferably configured as a vortex separator, particularly as a vortex stream separator or a baffle filter, and that the vortex separator (6) comprises at least one row, preferably two rows disposed one behind the other, of devices for forming turbulence in the air flowing through the boundary filter (6).

4. A filter arrangement according to any one of the claims 1 to 3, characterized in that the boundary filter (6) is disposed peripherally around the boundary region (4) of the filter layer (3).

5. A filter arrangement according to any one of the claims 1 to 4, characterized in that the boundary filter (6) is disposed on the boundary region (4), preferably perpendicularly to the plane of the filter layer (3) such that liquid droplets separated in the boundary filter flow into the boundary region (4) of the filter layer (3) and are absorbed there.

6. A filter arrangement according to any one of the claims 1 to 5, characterized in that the filter layer (3) comprises one or more layers made of expanded metal and/or a non-woven material and/or paper.

7. A filter arrangement according to any one of the claims 1 to 6, characterized in that the filter layer (3) is bordered by a U-shaped frame (5) comprising a lower frame leg (11) and an upper frame leg (10), the upper frame leg (10) being elongated in its dimensions for receiving the boundary filter (6).

8. A filter arrangement according to claim 7, characterized in that the frame (5), in the region of the boundary filter (6) disposed thereon, comprises orifices (9) for diverting the liquid running off from the boundary filter (6).

9. A filter arrangement according to claim 7 or 8, characterized in that the filter layer (3) together with the boundary filter (6) or the filter layer (3) together with the boundary filter (6) and the frame (5) forms a cartridge filter.

10. A filter arrangement according to any one of the claims 1 to 9, characterized in that the flow resistance of the boundary filter (6) is lower than the flow resistance of the filter layer (3), and that the boundary filter (6) allows a higher flow velocity than the filter layer (3).

11. A filter arrangement according to any one of the claims 1 to 10, characterized in that a screen disposed on the boundary filter (6), which screen extends radially outward beyond the edge of the filter arrangement (1) for guiding fumes and vapors toward the filter arrangement (1), particularly the boundary filter (6).

12. A filter arrangement according to any one of the claims 1 to 11, characterized in that the filter arrangement (1) is used for separating grease and grease droplets and/or water and water droplets from the air flowing through the filter arrangement (1).

13. A filter arrangement according to any one of the claims 1 to 12, characterized in that the boundary filter (6) comprises a row of X-shaped vortex elements (7), preferably two rows disposed behind one another of X-shaped vortex elements (7, 8), curved legs (7.1, 8.1) of the X-shaped vortex elements (7, 8) mutually engaging each

other while maintaining an air gap so that the air flow passes transversely through the X-shaped vortex elements (7, 8), as a result of which turbulence forms so that the particles and/or the liquid droplets contained in the air are thrown against a wall of the legs (7.1, 8.1) and are separated.

14. A filter arrangement according to claim 13, characterized in that the outer legs of the X-shaped vortex elements (7) end in the outer boundary region flush with the edge of the filter layer (3) or the frame (5) extending peripherally around them.

15. A filter arrangement according to claim 13 or 14, characterized in that the X-shaped vortex elements (7, 8) are connected to the filter layer (3) and/or to the peripheral frame (5), preferably to the frame leg (10), preferably by means of a screw assembly.

16. A filter arrangement according to any one of the claims 3 or 13, characterized in that the vortex separator (6) is made of an arrangement of horizontal curved elements (12), inflowing air (13) first impinging upon a streamlined shape of the curved elements (12) and then, in conjunction with at least one further curved element (12), experiencing at least one deflection.

17. The filter arrangement according to claim 16, characterized in that the curved elements (12) have a C-shaped configuration.

18. The filter arrangement according to claim 16, characterized in that the curved elements (12) have a V-shaped configuration.

19. The filter arrangement according to claim 16, characterized in that the curved elements (12) have an S-shaped configuration.

20. The filter arrangement according to claim 16, characterized in that the curved elements (12) have a drop-shaped configuration.

21. The filter arrangement according to claim 16, characterized in that the curved elements (12) have a dumbbell-shaped configuration.

22. A filter arrangement according to any one of the claims 16 to 21, characterized in that the arrangement of the curved elements (12) is formed of a combination of at least two different shapes.

23. A filter arrangement according to any one of the claims 16 to 22, characterized in that the curved elements (12) are disposed on a base plate (14).

24. A filter arrangement according to any one of the claims 16 to 23, characterized in that the base plate (14) extends along at least one edge of the filter layer (3).

25. A filter arrangement according to any one of the claims 16 to 24, characterized in that the base plate (14) is inclined toward the filter layer (3).

26. A filter arrangement according to any one of the claims 16 to 25, characterized in that a plate disposed above the curved elements (12), which plate together with the base plate (14) forms a nozzle (15) widening toward the filter layer (3).

27. A filter arrangement according to any one of the claims 16 to 26, characterized in that the boundary filter (6) is produced by means of injection molding.

28. The filter arrangement according to claim 27, characterized in that the boundary filter (6) is made of plastic.

29. The filter arrangement according to claim 27,

characterized in that the boundary filter (6) is made of light metal.

30. The filter arrangement according to claim 29, characterized in that the boundary filter (6) is made of aluminum.

31. A filter arrangement according to any one of the claims 16 to 30, characterized in that the boundary filter (6) is part of the frame (5) of the filter layer (3).

32. A filter arrangement according to any one of the claims 16 to 30, characterized in that the boundary filter (6) is part of an extractor hood (2).

33. A filter arrangement according to any one of the claims 16 to 32, characterized in that the boundary filter (6) comprises a longitudinally extending collecting duct (17) comprising a downwardly directed inflow orifice (16).

34. A filter arrangement according to any one of the claims 16 to 33, characterized in that the boundary filter (6) has a fold-out design.

35. A filter arrangement according to any one of the claims 16 to 34, characterized in that the boundary filter (6) comprises a closing device, preferably a slide or a flap, and can be connected and disconnected via the closing device.

36. The filter arrangement according to claim 35, characterized in that the connectability and disconnectability takes place manually.

37. The filter arrangement according to claim 35, characterized in that the connectability and disconnectability takes place automatically, preferably in that a spring pre-stressed flap is provided, which opens and closes automatically as a function of the pressure difference between the outside of the arrangement and the vacuum side, preferably as a function of the selected blower stage.

38. The filter arrangement according to claim 37, characterized in that the automatic connection and disconnection is controlled by a sensor system, preferably as a function of the air quantity to be cleaned.

39. A filter arrangement according to any one of the claims 16 to 38, characterized in that the boundary filter (6) is configured to be easy to disassembly.

40. A filter arrangement according to any one of the claims 1 to 39, characterized in that the boundary filter (6) is made of an expanded metal inclined toward the filter layer (3).

41. The filter arrangement according to claim 40, characterized in that the expanded metal of the filter layer (3) and of the boundary filter (6) is produced in one piece or separated.

42. A filter arrangement according to claim 40 or 41, characterized in that the expanded metal of the boundary filter (6) comprises fewer layers than the filter layer (3) in order to reduce the flow resistance of the boundary filter (6) and to increase the boundary extraction.

43. A filter arrangement according to any one of the claims 40 to 42, characterized in that the boundary filter (6) is held in a housing (21), the housing (21) comprising fastening elements for fastening the filter arrangement to the extractor hood.

44. A filter arrangement according to any one of the claims 40 to 42, characterized in that the boundary filter (6) is furthermore held by two components (23, 24), which two components are preferably produced using an extrusion method.

45. The filter arrangement according to claim 44, characterized in that the two components (23, 24) are held

on their end faces by means of caps (25).

46. A filter arrangement according to any one of the claims 40 to 45, characterized in that the boundary filter (6) comprises a bottom with at least one inwardly turned nozzle (15) formed thereon.

47. A filter arrangement according to any one of the claims 1 to 46, characterized in that several filter arrangements are arranged next to one another.

48. A filter arrangement according to any one of the claims 1 to 47, characterized in that the filter arrangement (1) is associated with at least one collecting space (22) for the condensate precipitated particularly in the boundary filter (6).

49. A filter arrangement according to any one of the claims 1 to 47, characterized in that the filter arrangement is configured as a cuboid or as a truncated pyramid comprising a bottom and with four edge sides, the filter layer (3) being provided on the bottom and a boundary filter (6) being provided on at least one of the edge sides.

50. An extractor hood (2), comprising a housing (2) with an extraction orifice and an air conveying device for the extraction of air through the extraction orifice, the extraction opening being provided with a filter arrangement (1) according to any one of the claims 1 to 49 described above.

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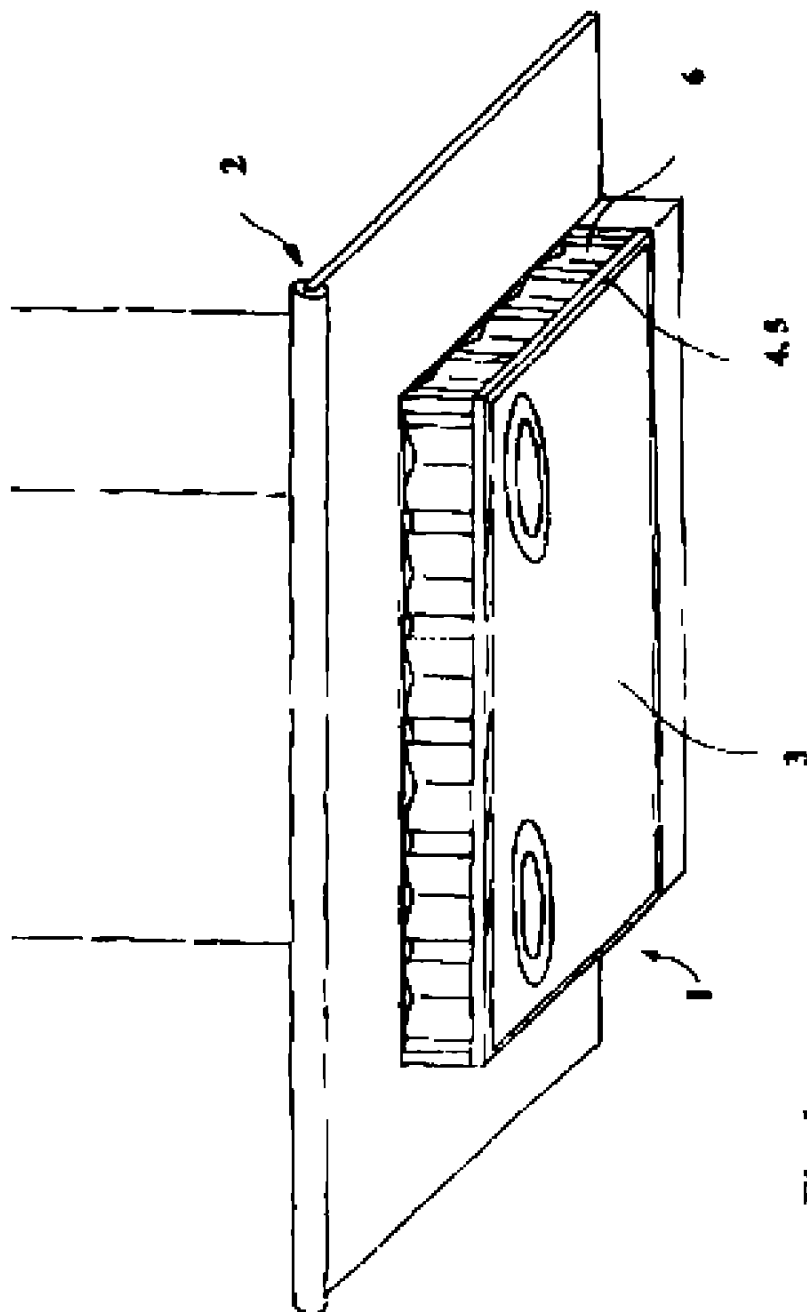
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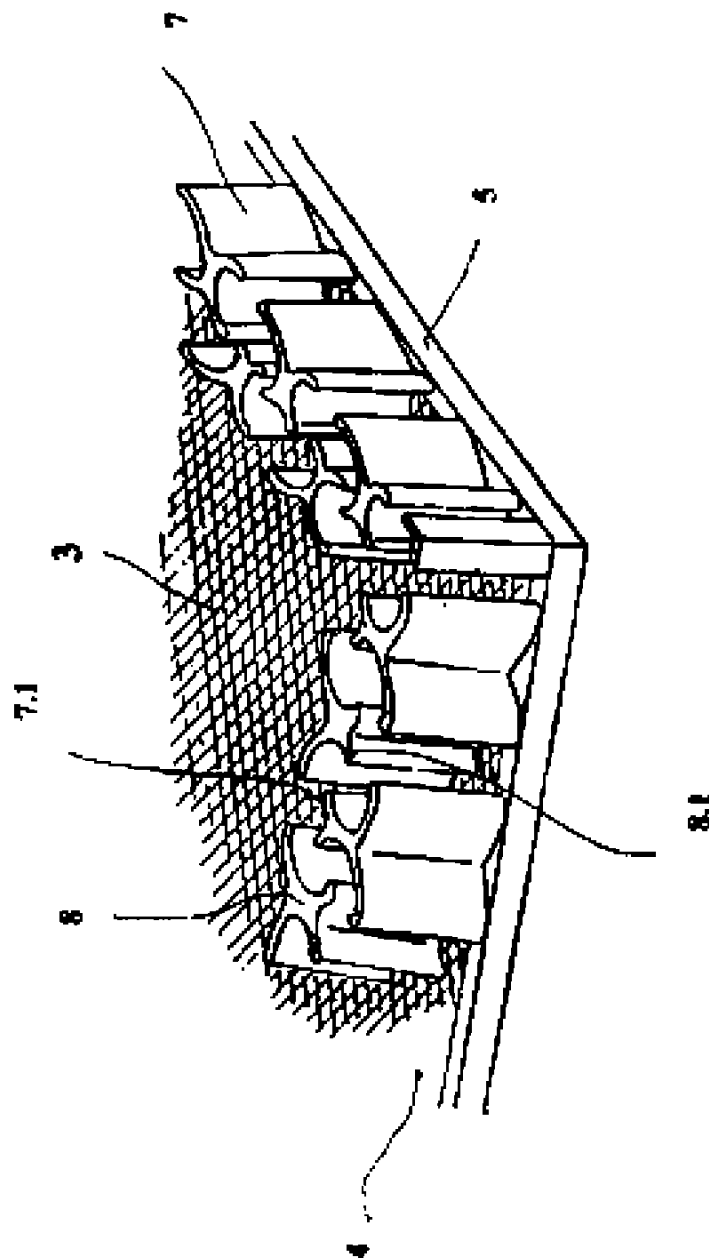


Fig. 2

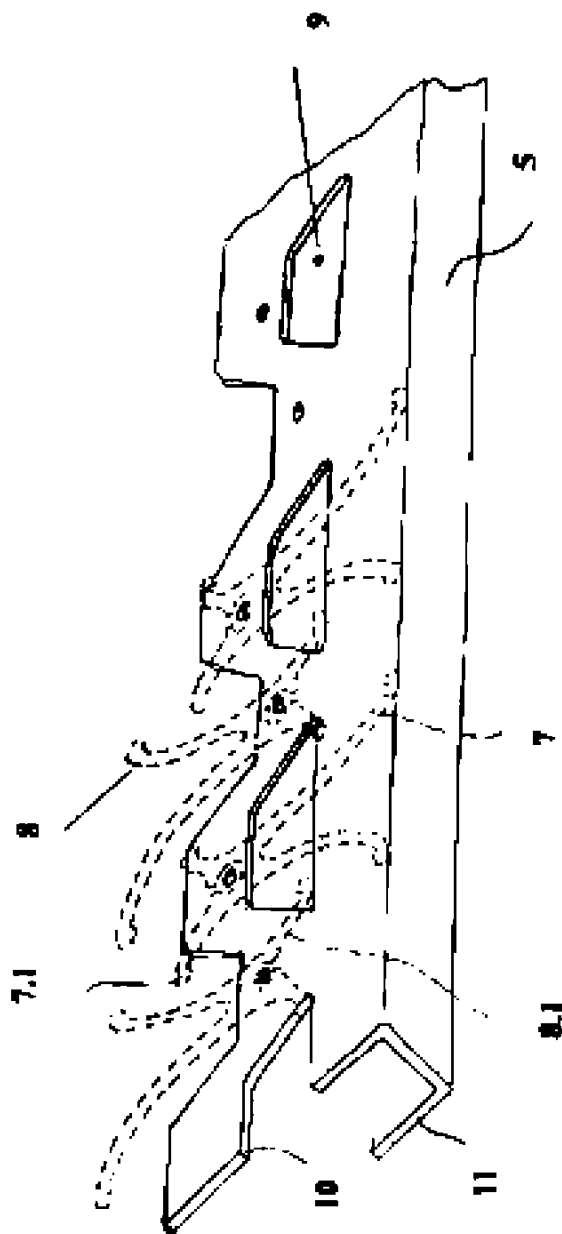


Fig. 3

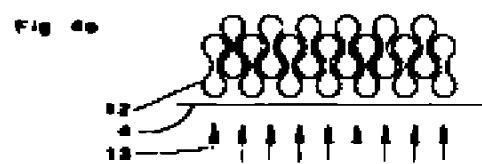
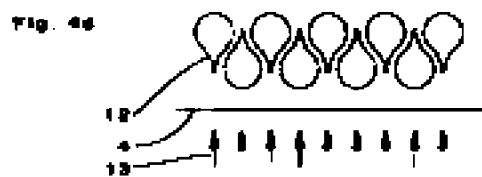
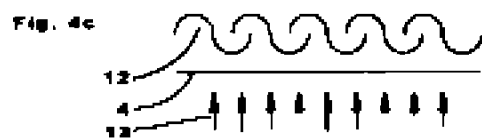
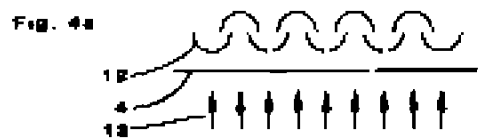


Fig. 5

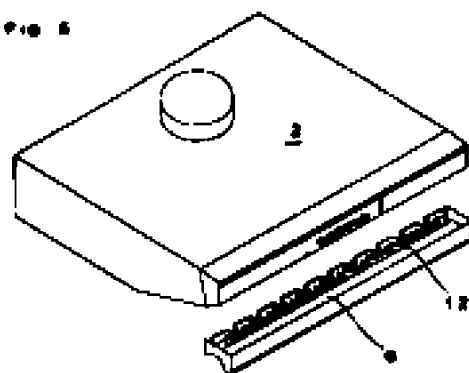
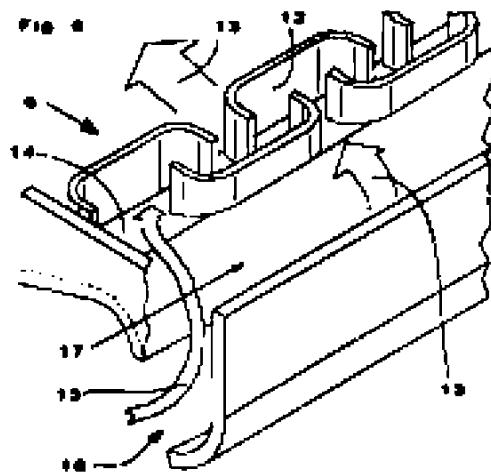


Fig. 6



**Fig. 7**

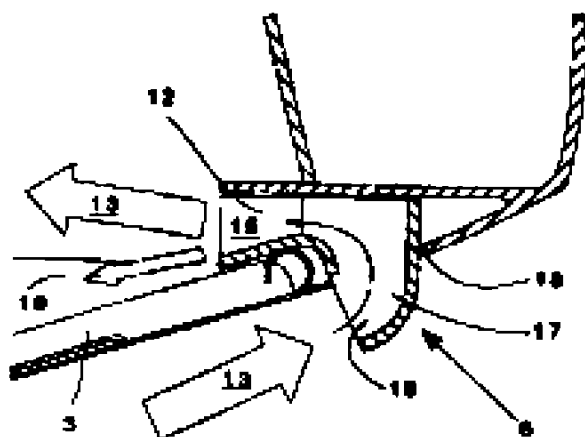


Fig. 2

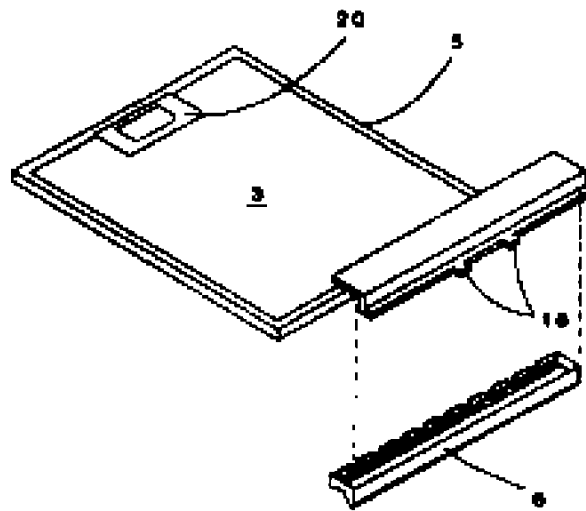
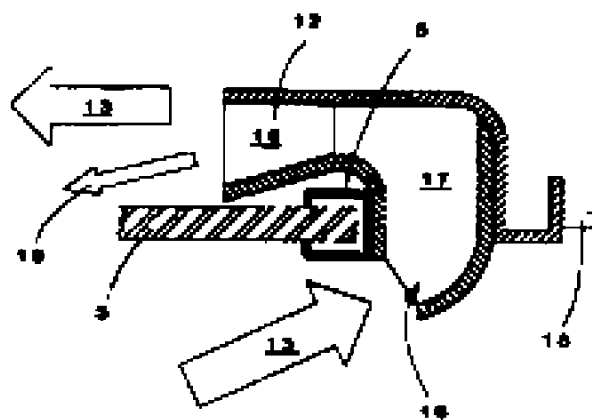




Fig. 8



14 10

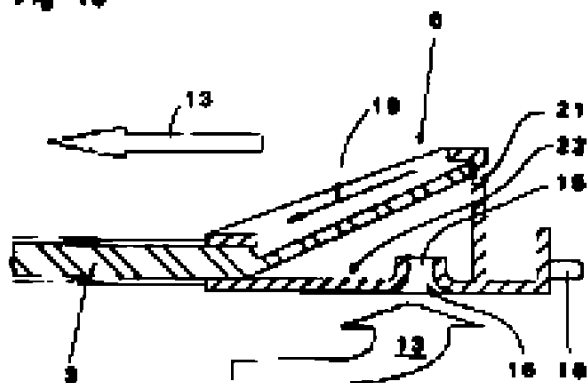


Fig. 11

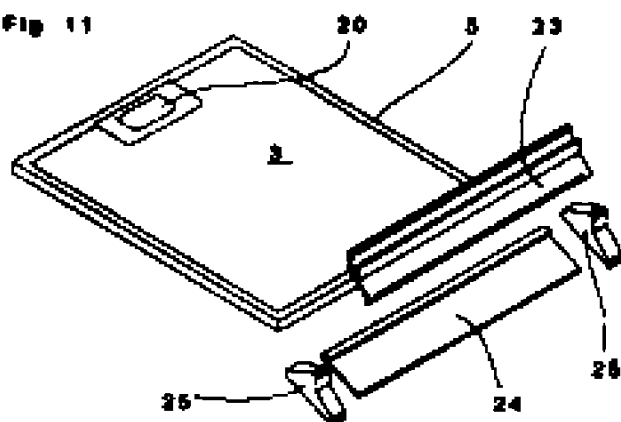


Fig. 12

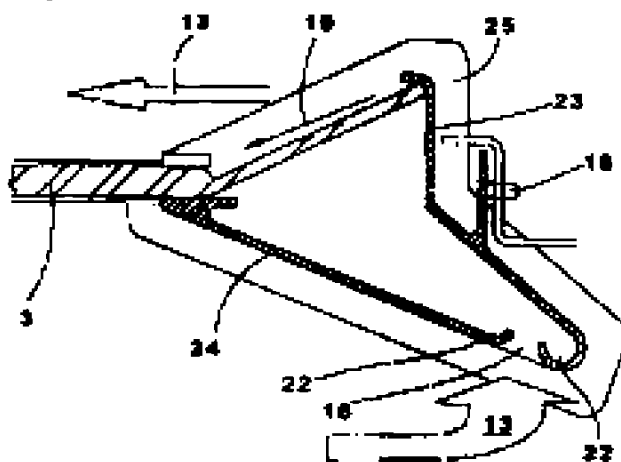
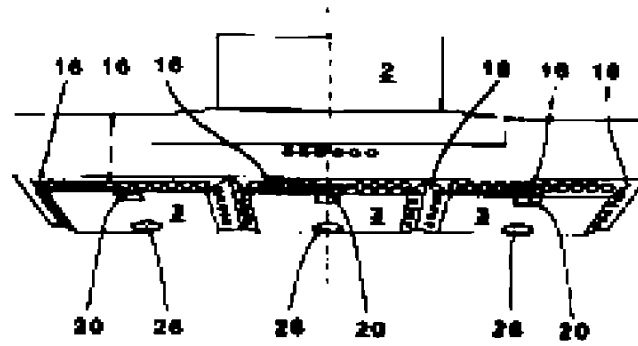


Fig. 13





# TRANSLATOR CERTIFICATION

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I, Kerstin Roland, a translator fluent in the German language, on behalf of Morningside Evaluations and Consulting, do solemnly and sincerely declare that the following is, to the best of my knowledge and belief, a true and correct translation of the document(s) listed below in a form that best reflects the intention and meaning of the original text.

## **MORNINGSIDE EVALUATIONS AND CONSULTING**

*Kerstin Roland*

Signature of Translator

Description of Documents Translated:

DE 102 08 474 A1: Filter Arrangement for an Extractor Hood

Date: May 26, 2006

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